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Policy options when giving negative externalities market value: clean energy policymaking and restructuring the Western Australian energy sector

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Abstract

Uncertainty surrounds the choice of instruments that internalise fossil fuel pollution at the local, regional and global level. This work outlines the considerable growth in the Western Australian (WA) energy sector and explores the available options and potential hazards of using specific instruments to internalise externalities. These core options are discussed with respect to liberalising energy markets, providing private investment certainty, and imparting commentary on the developments and consequences of reform in the WA context. As a large energy exporter, providing certainty for the WA energy sector investment and the community is necessary to maintain the current prosperity. Remarkably, in the decades of market reform progress, the absence of one essential element is evident: economic externalities. Policymakers are under increasing pressure to understand economic reform, new energy markets and the multifaceted repercussions they entail. With modern energy reform sitting squarely within the milieu of more efficient governments and climate policy, there are clear economic advantages to internalising negative and positive externalities and other market distortions during energy market developments. Ignoring market failures when commercialising government-owned energy utilities in de-regulated and competitive markets invites continued ad-hoc government interference that generates investment uncertainty in addition to a perplexed electorate.

Keywords

Externalities; policy; Australia.

1. Introduction

As externalities are a form of market failure, government interventions are justified in order to minimise their distortionary market influence and impact on the community (Gregory Mankiw *et al.*, 2000; Foxon *et al.*, 2005; Jaffe *et al.*, 2005). The recent Western Australian (WA) gas crisis caused by the June 3 explosion at Varanus Island was an example of such an intervention. Lack of long-term energy supply security planning in the WA energy development decisions lead to this single mishap cutting State gas supplies by one-third. While technically not defined as an externality, energy supply security issues distort energy markets in a similar manner to externalities and should also be incorporated into energy market restructuring (Owen, 2004; Garnaut, 2008).

At this point in time, a policymaker should not be surprised by a lack of consensus with currently available research findings on externality estimates and should be mindful that externality studies provide limited guidance (Sundqvist, 2004). The resolution of external cost estimates available are often coarse and policymakers should tread carefully when navigating towards achieving specific policy outcomes. Nonetheless, the implementation of a sound internalisation strategy requires a scientifically robust and comprehensive quantification of external costs (Krewitt, 2002). There are several reasonable explanations of discrepancies among the results of externality studies including differences in fuel characteristics, variable regulatory frameworks, inconsistent research methods, different study scopes, and the basic assumptions of the research (Sundqvist, 2004). For example, it is currently common to omit external costs such as climate change or nuclear proliferation. While difficult to quantify, these issues have the potential to become large external costs, and therefore should not be neglected in energy policy risk assessments (Eyre, 1997). This work aims to present available energy policy instruments that attempt to internalise negative externalities and characterise the most useful and problematic components to policymakers in the context of the WA energy sector.

Including externalities and other distortionary influences into the design of competitive energy markets is a logical evolution of the responsibility governments have to their constituents. Private investors are understandably not lining up to invest in non-excludable and non-rival public goods, such as clean air that can be acquired for free (Longo and Markandya, 2005). Governments must therefore be responsible for introducing value to public goods by internalising market failures (Künzli *et al.*, 2000; Sundqvist, 2004). The million-dollar question is: can policy strategies be developed and delivered that adequately protect public goods while enhancing the efficiency of competitive markets in a politically elegant manner? (Longo and Markandya, 2005).

Historically, regulation has formed the backbone of mechanisms for maintaining the quality of the environment. Regulation involves the imposition of standards or bans regarding emission and discharges, products or processes through licensing and monitoring (Owen, 2004). Regulatory measures to internalise externalities involves passing a law or issuing an administrative order banning certain practices and prescribing others, which frequently become politically divisive (Longo and Markandya, 2005). Government responses to issues such as energy supply security concerns and local environmental pollution have been influenced by various social and health crises for centuries. One example is the banning of coal burning in London in 1352 (Owen, 2004). While these extreme interventions in the event of crises are often politically abrupt, although necessary in the short-term, these wider impacts of these crises are often preventable.

More flexible energy sector regulatory techniques include mandatory minimum standards on the adoption of low emission technologies, energy efficiency measures for buildings, and restricted natural resource management practices (Owen, 2004). However, where cleaner and more efficient technologies are available it is difficult to justify that excluding the worst performing and most damaging technologies will reduce economic efficiency (Diesendorf, 2007). The use of "command and control" regulations are often said to be less efficient than economic measures, although this simplistic view disregards the predictable, administratively simple, and clear planning frameworks that standards and regulation provide (Eyre, 1997). In reality, a precise distinction cannot be made between market and regulatory instruments as all market-based instruments exist in a regulatory and institutional setting (Diesendorf, 2007). In

Australia, all of the most prominent competitive energy markets have major regulatory components, including the Mandatory Renewable Energy Target (MRET), the National Electricity Market (NEM), and the WA Wholesale Electricity Market (WEM) (International Energy Agency, 2001; Australian Greenhouse Office, 2003; Stewart, 2004; Western Australian Government Gazette, 2004; Independent Market Operator (Western Australia), 2006; Kent and Mercer, 2006; Outhred, 2007).

A major attraction of economic instruments is the potentially minor government involvement and the efficiency and flexibility they can provide to private firms. However, this potential depends on the appropriateness of the instrument for the unique conditions in individual markets (Longo and Markandya, 2005). Market-based economic instruments have been in use by the 1970s, and are designed to address market distortions with a mix of regulatory, economic, fiscal and financial incentives (Diesendorf, 2007). Two strengths of market-based economic measures are their economy-wide scope and compatibility with other measures (MacGill *et al.*, 2006). Economic instruments allow a reduction in the overall costs of pollution mitigation to industry, creating a financial incentive for firms to continually decrease pollution and allow state governments to raise funds that can be used to finance cleaning up pollution or to replace existing taxes and subsidies (Longo and Markandya, 2005). However, even amongst neoclassical economists, no unanimity exists on how to remedy the external effects of market transactions (Antheaume, 2004).

When policymakers choose the instruments to internalise the externalities in the energy sector, they must strive to find a solution that gives the best outcome in terms of: efficiency; cost minimisation; impact on the job market; security of energy supply; equity of the instrument; time-based closed-ended commitments; administrative ease; intellectual property innovation; certainty of the level of internalisation, and; equity of the instrument. Governments must also continually review the outcome of such solutions (Longo and Markandya, 2005). It is also important to acknowledge the limitations of externality methodologies to identify an optimal level of policy intervention (Krewitt, 2002). While there are many assumptions and limitations involved in full external cost accounting methods and instruments, making use of them is preferable to ignoring such costs (Antheaume, 2004).

Using precautionary principals and a knowledge of the strength and weaknesses of externality estimation methodologies allow policymakers to balance investment outcomes and navigate the spectrum of available polices that internalise energy pollution and other external costs. These decisions involve high political risk in WA, as the economy is highly dependent on energy and energy intensive exports. The WA energy sector provides a useful microcosm for studying the possible options and consequences of competitive energy market development with significant political, economic, social and environmental stakes for the Australian nation and the wider Pacific region.

2. WA: major energy user and exporter policymaking

With a population of slightly over 2 million, the state of Western Australia produces and uses a disproportionately large amount of energy. Politically, energy reform in a small state with large energy industries can be a hazardous exercise, depending on the reform agenda. To appreciate the magnitude of the highly charged reforms undertaken in WA, the author has provided a snapshot of the energy industry trends in terms of production and value. WA exports over 50% of the total primary energy produced (See Fig. 1). Unsurprisingly, the WA economy relies heavily on export income, with merchandise exports accounting for 39% of Gross State Product between 2001-02 and 2005-06. (Australian Bureau of Statistics, 2007).

The export dependent nature of the sector is illustrated by the obvious dip in primary energy production in 2003-04 in Fig. 1. This contraction was due to the increase in the value of the Australian dollar, which lead to less demand and weaker export earnings (Australian Bureau of Statistics, 2007). Between 2001-02 and 2005-06 the total primary energy production in WA has increased from 1740 to 1850 PJ. Over the same period primary energy use has increased from 727.4 to 808.3 PJ (Parliament of Western Australia, 2007). Between 2001-02 and 2005-06, crude petroleum oil and natural gas represented 12.7% and 8.1%

of the total value of WA's export commodities. The value of exports from the oil and gas extraction industry has increased from $7,389 million to $10,072 million over the period. Due to the relatively poor quality of WA coal reserves, the WA coal industry exported only $300,000 of coal in 2005-06 and produced a total of only 6 Mt. This is in contrast to the petroleum refining exports of $567.4 million for the same year (Australian Bureau of Statistics, 2007). The total annual value of WA's petroleum product production (petroleum condensate, crude oil, liquid natural gas (LNG), and natural gas) increased from $9,492 million in 2001-02 to $14,555 million in 2005-06. Over that period, WA's total production of crude oil and LNG was valued at $24,000 million and $18,000 million respectively (Australian Bureau of Statistics, 2007).

These large production values also correspond to sizable royalty receipts for WA. The WA State Government royalty receipts from petroleum and gas for each financial year between 2001-02 to 2005-06 was $428.3 million, $488.6 million, $416.3 million, $549.7 million, 678.8 million, respectively (Australian Bureau of Statistics, 2007). In addition, the 2007 WA State budget estimated actuals for the Commonwealth Petroleum Resource Rent Tax revenues for 2006-07 was $668 million, with a 2007-08 budget estimate of $699 million (The Government of Western Australia, 2007). With the current gas crisis reducing the gas output by one third, the loss of income and the follow-on economic impact is likely to be considerable. The WA Chamber of Commerce and Industry received 83 responses from their member businesses in the month after the crisis and found that 14% already have or will be shutting down if the crisis lasts three months (Pearson, 2008b; Rodgers, 2008). As full gas supplies are expected to be restored from Varanus Island after November, the WA Chamber of Commerce and Industry has stated that "every molecule of gas saved by not being burned to generate electricity, heat homes, heat water or to cook is a molecule of gas that could be made available to businesses and industry that are struggling to keep their doors open and their workers in a job" (Pearson, 2008a).

As several mining companies and exporters have also been forced to scale-back production, this is a significant blow to the WA economy. The crisis underscores the importance of including externalities and market distortionary factors into market reform and strategic planning as a form of adaptive insurance (Kane and Shogren, 2000). With the costs to businesses in the order of hundreds of millions of dollars every week, the introduction of a market value to measures that increase energy security and diversify energy supplies appear politically sensible (Lovelle, 2008). The growing number of employees and economic dependence on energy and energy intensive industries adds additional political elements to undertaking market reforms. The total number of WA employees involved in coal, oil and gas extraction, electricity and gas supply and petroleum refining industries have increased over 75% in recent years (See Fig. 2).

This employment increase continued over an annual average decrease in WA crude oil production of 6.4% between 2001-02 and 2005-06 due to declining field yields and cyclone damage. A combination of these declines and the increase domestic demand for transport fuel has resulted in a volumetric reduction of crude oil exports of 35.5% over the same period. This is in contrast to LNG production increasing 57.6% from 7.4 Mt in 2001-02 to 11.7 Mt in 2005-06. In addition to the energy production sector employees, the number of energy intensive resource jobs has increased 60% from 43,400 to 69,700 over the four years between 2001-02 and 2005-06 (Australian Bureau of Statistics, 2007). These large employment, production and export figures presents major challenges to any restructuring of the energy and resources sector, especially to a region with such a relatively small populace (Peterson and Rose, 2006).

2.1 Energy sector reform to date

Despite the enormity and political acuteness of the task, the Commonwealth and WA State Government have undertaken a range of alterations to energy markets. The reform of the domestic natural gas industry can be traced to the Natural Gas Strategy adopted by the Commonwealth Government in 1991. The strategy promoted: non-discriminatory open access to pipelines; a light-handed approach to regulation; intensified interstate trade through removal of regulatory barriers, and; infrastructure interconnection (International Energy Agency, 2001). Another significant change was a federally appointed inquiry into electricity competition known as the Hilmer Report, which subsequently formed the basis for the National Competition Policy (NPC). The Hilmer Report considered competition in terms of six elements: limiting anti-competitive conduct by firms; reformation of competition restricting legislation; reforming structural change to monopolies; provision of third party access to public facilities; restriction of monopoly pricing behaviour, and; fostering competitive neutrality between private and government adversaries (Beresford, 2000). As they stand, the dominant objective of Australian electricity markets is to minimise energy prices to consumers. While this is a sensible objective, it does not adequately incorporate the increasing demand for energy, external costs or energy efficiency on an equal basis with supply cost concerns (Diesendorf, 2007).

The absence of price mechanisms that recognise major externalities associated with energy use in competitive markets is distortionary. The classic example is when clean energy technologies such as wind turbines, compete in electricity markets with fossil fuel technologies when no value is placed on pollution. Naturally, private investors are looking to maximise their private economic return. If a market enables participants to impose costs to others unconnected with the investment, the option that exports the most cost is more likely to be profitable. While markets are structured to enable participants to impose costs on others, the cost differential between clean and fossil-fuel technologies is likely to be closed slowly (Fairfield, 2006).

Western Australia is the only state that is not part of the National Electricity Market due to practical reasons of geography (MacGill *et al.*, 2006). To facilitate an efficient electricity sector, the WA State Government opted to develop a stand-alone electricity market tailored to the unique growth occurring in the state. In recent years, peak electricity demand growth has outstripped generation investment and WA has seen electricity blackouts during summer peak demand. From 2001-02 to 2005-06 the electricity sector final energy use has seen a growth of 19% from 82.2 PJ to 97.7 PJ (See Fig. 3) (Parliament of Western Australia, 2007).

It was deemed politically necessary to reform the states electricity sector to ensure a secure electricity investment programme. The WA government owned and operated utility reform included vertical disaggregation into separate generation, retail, and transmission/distribution components, together with corporatisation or privatisation (International Energy Agency, 2001). The disaggregation of the single vertically integrated government owned utility into four components allowed the establishment of the WA Wholesale Electricity Market (WEM). The aim of the WEM is to provide a more efficient mechanism for energy industry participants to trade electricity within the South-West Interconnected System (SWIS) (Independent Market Operator (Western Australia), 2007). The WEM provides an opportunity to encourage a more reliable and competitive energy industry using demand side management options and private renewable energy investment (Western Australian Office of Energy, 2006).

The WEM developers recognised that ensuring sufficient generating plant investment was required in a small electricity network such as the SWIS. To meet the forecasted future electricity demand on the SWIS, the Reserve Capacity Mechanism was developed. This mechanism ensures adequate capacity to meet SWIS peak demand by paying owners of certified generating plants and demand side management providers to be available to either generate or reduce demand. The Independent Market Operator (IMO) purchases credits through an auction process as energy demand increases (Independent Market Operator (Western Australia), 2008a). Although the development of the WEM saw the incorporation of generation capital supply security with the Reserve Capacity Mechanism, it arguably disregards fuel supply security and the investment requirements for electricity distribution.

One role of the IMO is to collect and disseminate technical and market data and investment opportunities in the WEM. This revealing information has become a valuable resource to investors and policymakers. The IMO has stated for some time that the insufficient capacity from the small Dampier to Bunbury gas pipeline has inhibited further gas-fired generation investment on the SWIS. Recently the pipelines Stage 5B pipeline expansion and further extensions have largely overcome this issue, however, restrictions in new gas supplies and recently higher gas prices continue to limit gas-fired investment (Independent Market Operator (Western Australia), 2008a). With the onset of the gas crisis these fuel supply security issues have been exacerbated, although not in the way many would have expected. As around one sixth of the generation capacity in the SWIS is able to run on liquid and gas fuels, the daily percentage contribution of the liquid fuels to SWIS demand increased from between one and six percent to between approximately ten and thirty percent. The increase use of distillate and diesel is likely to result in liquid fuel imports. Interestingly, the gas crisis and the subsequent government calls to reduce energy consumption appears to have had no effect on the operational demand on the SWIS (Independent Market Operator (Western Australia), 2008b).

Outcomes of competitive markets depend strongly on the direct costs faced by competitors. Consequently energy markets are unlikely to deliver a reduction in pollution or improve energy security without special consideration of internalising market distortions and giving them a market value. Distorted prices lead to sub-optimal investments and operating decisions that incur unnecessary long-term costs unless such externalities are taken into account (Outhred *et al.*, 2002). The continued growth of operational demand over the gas crisis is a clear example of when operational decisions in both the public and private interest are ignored when they have no market value. Another good example of electricity sector markets providing no incentive to invest in essential elements of supply security is the under-investment in network infrastructure.

The disaggregated network utility natural monopoly (Western Power) reported that a great deal of investment in network upgrades were required before substantial generation can be accommodated in the SWIS. Western Power publishes an Annual Planning Report (APR), which includes the status of the SWIS transmission and distribution system. The transmission system is nearing capacity in several locations, predominantly due to new generation capacity requirements and energy flow requirements across the network. While the WEM reduces electricity prices by increasing competition between electricity retailers and generators, the WEM as it stands is unable to provide certainty of where new generation will be built with sufficient time for the network utility to build the electricity infrastructure required to connect it to. The geographical generation uncertainty and the temporal disparity between the WEM Capacity

Mechanism and Western Power's planning and construction timetable has lead to the decision of undertaking extensive upgrades through the transmission system. Unfortunately, the length of time required to complete these upgrades have not fully solved problems concerning new generation capacity being unable to receive certification under the Capacity Mechanism rules and the subsequent delay or postponement of its construction (Independent Market Operator (Western Australia), 2008a). In addition the cost of the extensive network upgrades are being absorbed by the taxpayer, a minority of which have been refused connection due to insufficient generation and transmission capacity in the southwest of the SWIS. As many of these concerns are external to the function and mandate of the WEM, it is clear that generation investments under current structures allow costs of network upgrades to be passed onto taxpayers with little regard for the economic efficiency of the total investment required.

3. Market restructuring policy options

Energy market restructuring is a complex, difficult and recurring processes that has engineering, economic, social, commercial, legal and policy dimensions and takes place within a broad societal context (Outhred, 2007). Factors to be taken into account when planning energy systems include economic cost, development, energy security, environmental concerns and equity. Governments play an important role in forging policies, bodies and measures that reduce conflict between these areas (MacGill *et al.*, 2006; Peterson and Rose, 2006). Independent market operators and regulators assist governments can make significant progress when provided with a mandate and sufficient capacity to act on the behalf of the public interest. A range of internalisation tools are available to such bodies, but none provide a complete solution (Eyre, 1997). Therefore, a mix of policy instrument options is often required to obtain best acceptable outcomes for all stakeholders (Longo and Markandya, 2005).

3.1 Policy option A: Taxes

Energy taxes are a relatively straightforward solution, although in practice there are complications when quantifying damages and differentiating costs on various technologies and fuels. For example, the impact of a simple carbon tax would not recover the external costs of nuclear fuels and technologies, which would be an unmerited advantage for the nuclear industry (Owen, 2004). The tax revenue would also have to be distributed in a manner that worked actively with the tax, as to not reimburse the industries that caused the external costs in the first place. Taxes are theoretically a preferred option where there are many polluters and where damages are independent of the point source, such as when coal-fired generation particulate emissions exacerbate upper respiratory tract infections (Eyre, 1997; Kjellstrom *et al.*, 2002).

The worst of any tax imposed on the poorer sections of society would also have to be offset to ensure the tax burden did not disproportionately affect them (Owen, 2004). It is important for policymakers to keep in mind that increasing the unit prices of energy does not lead to an increase in energy bills when energy is used more efficiently. In the long run, the increased cost of goods and services from the introduction of Pigovian style taxes will tend to increase the relative generation of positive externalities in an economy. For example, a coal price that takes into account negative externalities will stimulate technological advancement in energy resources and efficiency, which reduces coal consumption and its associated negative externalities (Diesendorf, 2007).

Carbon taxes at the international level have been discussed extensively, but it has never been politically acceptable to a wide range of countries. Carbon taxes in various forms have been implemented in Denmark, Finland, Germany, the Netherlands, Norway, Sweden, New Zealand and the United Kingdom (Owen, 2004). Sweden is one of few countries that managed to include coal in its carbon tax, but many countries continue to subsidise coal production (Longo and Markandya, 2005). A carbon tax in Australia is extremely unlikely in the current economic conditions and the energy intensiveness of much domestic production and consumption.

3.2 Policy option B: Subsidies

Where taxing polluters is deemed to be politically unacceptable, targeting grants and subsidies towards clean energy technologies is one option (Owen, 2004). In recent times, subsidies have been the preferred instrument for Australian domestic energy policy. Policymakers should be aware that governments choosing technology "winners" is always controversial. Governments are not often the appropriate arbiters of determining the technology that is to be supported, as past experience shows that political momentum forming behind ill-advised, technology specific initiatives that stifle superior technological options, can become politically difficult to stop (Jaffe *et al.*, 2005). One future example of this form of "lock-in" may be the current corn-based ethanol subsidies in the USA.

Subsidising cleaner alternatives can reduce external costs, but will not internalise them (Eyre, 1997). Nonetheless, subsidies given to clean energy industries should, in theory, have an overall positive impact on the job market by creating more jobs than conventional technologies (Longo and Markandya, 2005; Diesendorf, 2007). Many clean technologies require increases in the skilled domestic labour force per unit of energy output. This is the case in Australia as clean technologies often contain more domestic content than the majority of imported conventional energy system components (Diesendorf, 2007).

The most significant renewable energy technology subsidy is the Renewable Remote Power Generation Programme (RRPGP). The RRPGP was introduced in July 2000 and was originally an initial $264 million to support the replacement of diesel in diesel-fuelled SPS systems with renewable system components (Parliament of Australia: Senate, 2000). Funds were allocated to the States and the Northern Territory on the basis of the certified diesel fuel excise paid in each jurisdiction by public generators (Australian Greenhouse Office, 2003). The RRPGP provided up to 50% of the capital value of the replacement or new renewable generation capacity for off-grid users of traditionally fossil fuel powered systems. From 2005, eligibility was extended to fringe-of-grid installations, displacements of other fossil-fuels (principally natural gas), energy efficiency measures and solar hot water heaters (Outhred *et al.*, 2002). From 2001-02 to 2006-07 the total capital cost subsidies paid out under the RRPGP in WA was slightly over AUD$41 million. The introduction of this rebate saw a massive increase in renewable energy components in WA and has underpinned the development of WA's renewable energy industry (Parliament of Western Australia, 2007). Throughout 2008, the RRPGP funding has been revised.

In addition to rebates, another method used to increase uptake of zero pollution technologies are feed-in tariffs. A feed-in tariff (FiT) involves an obligation on the part of energy suppliers to purchase electricity produced by particular technologies and/or accredited producers at a specified price guaranteed for a period of time, generally 15-20 years (Longo and Markandya, 2005; Diesendorf, 2007). FiTs and competitive bidding processes result in an external cost minimisation, but as they do include subsidies, they can entail significant fiscal and administration costs. Nonetheless, international experience with FiTs have shown that this instrument has effectively diffused new technologies into energy supply systems (Longo and Markandya, 2005). In Australia, several states and territories have investigated FiTs, although at this time only Queensland and South Australia have existing schemes (International Energy Agency, 2008) Queensland's Solar Bonus Scheme pays small electricity customers (defined as customers that consume less than 100MWh yr^{-1}) \$AUD0.44 kWh^{-1} (net) from photovoltaic systems less than 10kVA for single phase and 30kVA for 3 phase systems until 2028 (Queensland Department of Mines and Energy, 2008). South Australia has an identical scheme although the small electricity customer must consume less than 160MWh yr^{-1} (Government of South Australia, 2008). The Victorian Government will introduce a premium FiT in 2009 that will pay AUD\$0.60 kWh^{-1} (net) for PV systems that are no larger than 2kW (Government of Victoria, 2008). The Australian Capital Territory (ACT) has passed FiT legislation, which is expected to be implemented by the end of 2008. The ACT scheme pays 3.88 times the domestic electricity price for photovoltaic systems that are equal to or less than 10kVA, 3.104 times for systems greater than 10kVA up to 30kVA, and 2.91 times for systems larger than 30kVA (The Legislative Assembly for the Australian Capital Territory, 2008). WA has no FiT to date, although the newly elected government has indicated in-principal support for a WA FiT scheme.

One significant advantage of FiTs is the certainty it gives to investors (Longo and Markandya, 2005). If investors can determine the output of an energy system and receive a government guaranteed price for each unit of energy exported to energy markets, they simply find it easier to obtain capital funds and the investment becomes low risk. FiTs would also complement the Australian policymaker preference to subsidise the capital costs of clean energy system components (Diesendorf, 2007).

3.3 Policy Option C: Certificates

Green energy certificates (or credits) are entities that give electricity retailers more flexibility when regulation imposes a minimum requirement of a percentage of total electricity sold to be sourced from renewable energy capacity. These cross-subsidies are commonly funded by either all electricity consumers, the taxpayer, or by individuals voluntarily paying higher unit prices for "green electricity" (Longo and Markandya, 2005; Diesendorf, 2007). Producers of accredited green electricity are allocated green certificates to sell, which improves the economics of clean generation investments. These certificates allow clean generators to compete in markets with polluting technologies that externalise their pollution costs. Such schemes effectively reward clean energy producers for not producing external costs (Longo and Markandya, 2005). In Australia, the Renewable Energy (Electricity) Act 2000 sets the framework for a Mandatory Renewable Energy Target (MRET) and gave rise to the Renewable Energy Certificate (REC). The Office of the Renewable Energy Regulator (ORER), a statutory agency, administers the Act, the Renewable Energy (Electricity) Charge 2000 and the Renewable Energy (Electricity) Regulations 2001. One REC is created by accredited renewable energy generators and registered by the Office of the Renewable Energy Regulator (ORER) for each MWh of clean electricity exported to networks (Office of the Renewable Energy Regulator, 2006). RECs are used to demonstrate compliance with the objectives of the MRET to increase renewable electricity generation, as electricity retailers must purchase increasing amounts of RECs in proportion to the amount of electricity they sell (Office of the Renewable Energy Regulator, 2006).

GreenPower is another mechanism that operates in Australia and is available in Western Australia. GreenPower works alongside the MRET and allows greater flexibility in transferring RECs to clean energy markets, such as carbon offsetting companies. These certificates do not internalise the social and environmental costs of energy production, but do subsidise socially and environmentally benign technologies (Owen, 2004). The main tasks required of governments in the trading of green certificates is to fix the quota and provide long-term goals for clean energy use and provide the often considerable investment required to verifying certificates and accrediting generators (Longo and Markandya, 2005). These schemes are attractive to governments as they can be justified as reducing the levels of external costs imposed on the community, while being more palatable than a tax (Owen, 2004). Green electricity schemes are attracting an increasing number of subscribers in Australia. Although their fatal flaw is most consumers are unwilling to pay higher prices to secure public goods from which everyone can benefit (Longo and Markandya, 2005).

3.4 Option D: Emission trading

Emissions trading has recently been proposed as the "central instrument of Australian mitigation" in the draft Garnaut report, released in June 2008 (Garnaut, 2008). Emission trading schemes involves setting a target of permitted emissions, allocation permits to pollution producers, choosing an amount of permits appropriate to a target, and mandating producers to acquire enough permits to cover their emissions (Diesendorf, 2007). Legislation usually forms the basis for emitter compliance and is generally mandatory with penalties for non-compliance (Owen, 2004). An emission permit is a transferable permit for emitting a specific quantity of pollution into the atmosphere for a specified duration. Producers either purchase or are allocated such permits and thereafter are able to trade these with other firms or surrender them for pollution produced. Firms investing in pollution reduction processes and technologies are able to trade more permits and recover some of the costs of the investment in efficiency (Nenkova, 2005). There are a variety of forms of emission trading schemes, including "cap and trade", "baseline and credit" as well as variations where permits can be allocated to individuals and/or large emitters. The nuances of these variants are arguably less politically important than the method that pollution permits are allocated in a trading scheme.

In a tradable emission permit approach, the allocation of permits among industries is often the subject of controversy, as the two methods, grandfathering and auctioning, have very different abatement costs to the polluter. Grandfathering on the basis of the historical output means the polluter receives permits equivalent to their emissions for free and must only pay the abatements cost. On the other hand the alternative of auctioning permits forces polluters to pay the cost of abatement at a new emission level (Longo and Markandya, 2005). From a policymakers perspective, grandfathering provides greater political control over the effects to particular industries, while auctions reduce politically contentious arguments surrounding lobby groups, allows greater flexibility in cost distribution and gives greater incentives for new market entrants and technological innovation (Longo and Markandya, 2005; Diesendorf, 2007; Garnaut, 2008). Auctioning emission permits also minimise costs to governments (Longo and Markandya, 2005; Commonwealth Government of Australia, 2008; Garnaut, 2008). A combination of grandfathering and auctioning is one means of conciliation, with one or the other being phased out over time.

Emission trading is regarded as efficient because it combines the advantage of flexibility and efficiency free markets while having a level of certainty of the reduction or final emission level (MacGill *et al.*, 2006; Commonwealth Government of Australia, 2008; Garnaut, 2008). In reality, it may be difficult for policymakers to predict how wide-ranging market-based instruments may interact with other existing policy measures (MacGill *et al.*, 2006; Garnaut, 2008). In light of the mixed phase I progress in the European Union Emission Trading Scheme, it is likely to be difficult to determine if an Australian domestic scheme will effectively reduce emissions beyond business as usual.

3.5 Option E: Informative measures & voluntary agreements

Governments can influence the actions of households and firms by utilising advertising campaigns, environmental labelling, demonstration projects and by facilitating environmental initiatives (Owen, 2004). Other less common approaches in Australia that are available to WA policymakers are generation disclosure legislation. Generation disclosure refers to the requirement of utilities to provide their customers with additional information about the energy they are supplying. This can include a number of useful indicators, such as fuel mix percentages and emission statistics (Longo and Markandya, 2005).

A new class of semi-informative measure, voluntary agreements are often referred to as an economic instrument. These instruments include commitments made by individual companies as a result of negotiations with public authorities. They have a potency to influence behaviour that lies between informative measures and economic instruments. It is often argued that voluntary approaches are unproductive for policymakers as they often do not produce significant results, with firms choosing easy to reach targets that reflect "business as usual" trends of increasing efficiency for financial reasons (Longo and Markandya, 2005; Diesendorf, 2007; Commonwealth Government of Australia, 2008).

Assessment of the success of Australian voluntary agreements, such as the Greenhouse Challenge and Greenhouse Challenge Plus programmes have been difficult due to the untidy distinction between emission reduction attributable to the programme or those which may have resulted from normal business efficiency measures (Diesendorf, 2007). Another issue surrounding voluntary agreements comes with the dissipation of the initial pressure once an agreement is signed. The firms then have the opportunity to not comply with their commitments because most agreements do not include monitoring or sanctioning mechanisms. Voluntary agreements can be an expensive option for both the government and the companies involved, as time and negotiation costs can be large when parties have difficulty in reaching agreement. Voluntary agreements are best suited to industries with a management history of understanding their specific environmental problems alongside substantial incentives for compliance and demanding targets (Longo and Markandya, 2005; Diesendorf, 2007).

4. Words of caution for the policymaker

There is no single policy instrument to internalise all externalities or market distortions and a range of policy instruments are often needed in regions such as Western Australia (Eyre, 1997). Whatever array of instruments are chosen by policymakers, it must be made clear that market-compatible approaches should be used to incorporate economic social and environmental externalities and market distortions (Outhred *et al.*, 2002). A policymaker must carefully consider the consequences that instruments will have on the economy and carefully consider who will finally pay for the externality (Garnaut, 2008). The most efficient mechanism is not always the most economically equitable. An increase in production costs are likely to be passed on to consumers, who will bear the burden of the externality (Longo and Markandya, 2005). Market-based approaches provide incentives for parties with vested interests to influence market designs that provide a competitive advantage to them. Policymakers should not be surprised when firms explore weaknesses to exploit when seeking to minimise the costs of meeting their obligations: the greater the complexity of policies, the greater the likelihood that a weakness exists (MacGill *et al.*, 2006).

Proponents of the established energy system often attempt to block the diffusion of competitive technologies by influencing the institutional framework so they retain the competitive advantage (Jacobsson and Bergek, 2003). This may make business sense to individual firms, but will be to the detriment of the market and will likely introduce unnecessary complexity into the policy. A good example is the common argument against including negative externalities as it may harm international competitiveness. There are a number of remedies for this instance, including: wholesale exemptions; negotiated agreements; offsetting tax deduction and financial incentives for energy efficiency improvements, and; border tax adjustments. Border tax adjustments on exports work in a similar manner to the Australian Goods and Services Tax (GST). A full rebate is payed to the exporter to offset the increases in production costs caused by internalising externalities domestically. Goods sold domestically would not receive the adjustment payment (Diesendorf, 2007).

Attention should focus on polices and instruments that assist system innovation and manages interfaces between potential partners, rather than the common Australian approach of unfairly supporting individual companies (Longo and Markandya, 2005). The policymaker should be aware of the reasons why economists prefer fair and competitive market structures. Open and competitive markets: efficiently distribute resources; self-correct; stimulate research and development; produce elastically, and; allow access to any party that wants to enter the market (Diesendorf, 2007).

One key driver of policy development must be that measures actually drive change. There are moral hazards for market designers as there is the potential to design market measures that free-ride on pre-existing policy measures. If the targeted outcomes will likely happen in the absence of the measure, there is little point (MacGill *et al.*, 2006). The systematic long-term evaluation of policies will also improve the chance of developing a solid empirical base for policies that maximise the returns to the community and minimise economic inefficiencies. Policy experimentation should logically work hand-in-hand with systematic policy evaluation, even though the evaluation of policies can be difficult in practice and may undermine political support for such programmes. Policymakers should be aware that particular methods of policy evaluation can exaggerate or underestimate the more intangible benefits of policies, such as social impacts (Jaffe *et al.*, 2005). However, not attempting to evaluate policies at all will simply perpetuate ignorance and leave policymakers vulnerable.

5. Conclusion

Globally, policy analyses have increasingly focused on the effects of negative externalities on human health, environmental quality, economic development, or institutional objectives such as emissions growth management (Peterson and Rose, 2006). Providing regional certainty for private industry and the community in places similar to Western Australia is necessary to maintain economic prosperity into the medium to long-term. There is growing pressure on policymakers to comprehend the complicated worlds of economic reform and energy markets to make decisions regarding the future energy supply systems we choose to construct. Economic efficiency is crucial for good energy policies because the energy sector represents a huge capital investment. Any small inefficiency can send considerable repercussions throughout the economy. With energy reform sitting squarely within the milieu of climate policy, there is a logic to internalising negative externalities in the course of existing energy market evolution.

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Fig. 1. 2001-02 to 2005-06 WA Primary Energy Production & Use.

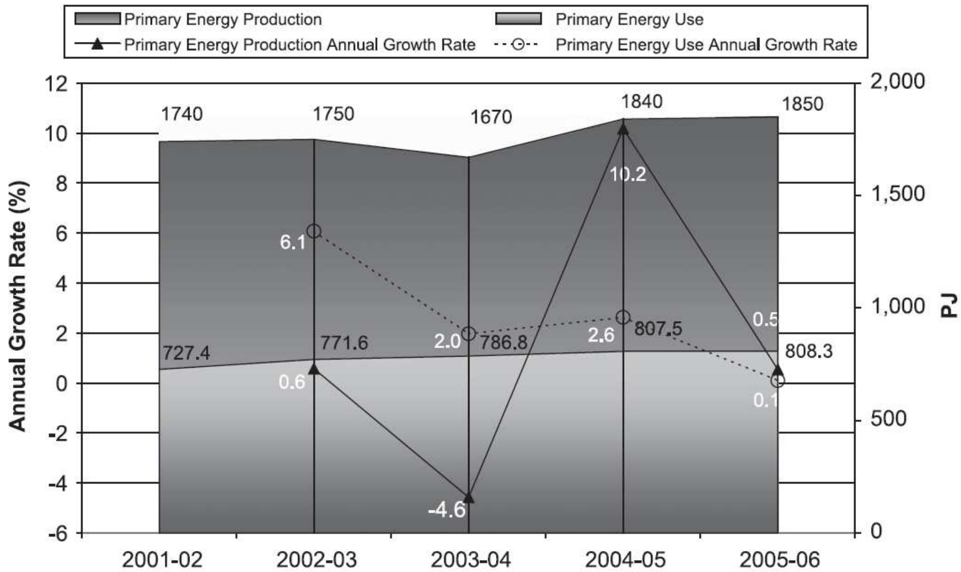

Fig. 2. Total WA Fossil Fuel Employees from 2001-02 to 2005-06.

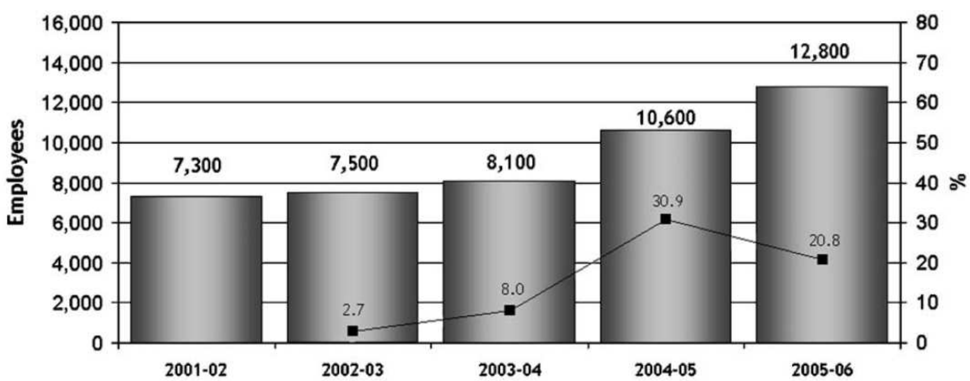

Fig. 3. Total & Annual Growth Rate of Final Energy Use for the WA Electricity Sector from 2001-02 to 2005-06.

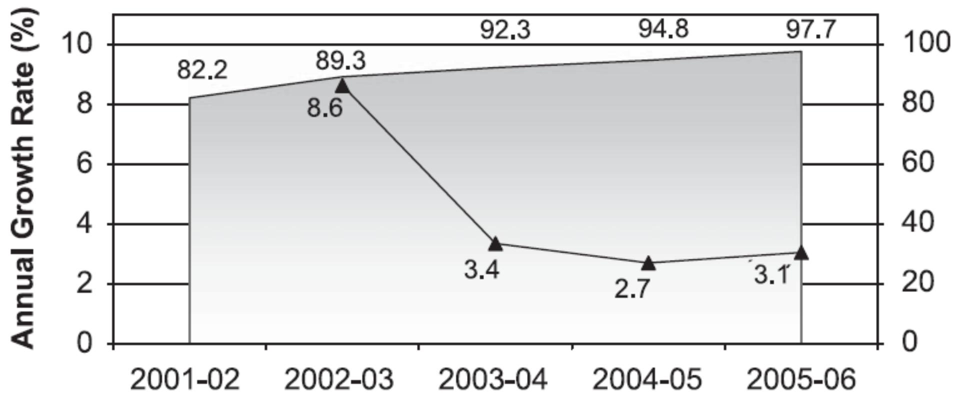

Fig. 4. The increasing SWIS electricity demand despite the gas crisis.